1. Introduction

RF-MBE (Radio frequency plasma assisted molecular beam epitaxy) is the most simple growth method for group III-nitrides using group III metal atoms and N atoms. It uses chemically safe materials only and a material saving growth method. AM-MEE (the activity modulation migration enhanced epitaxy) of RF-MBE method is a candidate to grow high quality group III-nitrides on a large size Si wafer. The AM of an rf discharge means the activity selection of chemically active nitrogen atoms (N+N*), where N and N* are ground and excited atoms, respectively, produced by a high brightness (HB) discharge mode and physically active excited nitrogen molecules N₂* produced by a low brightness (LB) discharge mode [1].

In this report in order to improve lattice mismatching of AlGaN/GaN HEMT, In₀.₁₇Al₀.₈₃N mixed nitride film, which is a lattice matching material for GaN film as shown in Fig.1, is grown by AM-MEE and the charaltalization of these films is presented.

2. Experimental

An IRFS-501 rf nitrogen radical source made by Arios Inc and a periodical power controller were in a VG-80H MBE chamber. After preparing a DBL of AlN/β-Si₃N₄/Si, which is formed by reactive epitaxy with Al and an intermediate layer of β-Si₃N₄ [2-3] on Si, the AM-MEE growth of InₙAlₓ(1-x)N was performed. The detailed procedure of AM-MEE is shown in elsewhere[3-5]. The time sequence of AM-MEE is shown in Fig. 2 and 3 schematically. To prove the lattice matching HEMT structure of InAlN/GaN/AIN/DBL/Si(111) was prepared. Mixing effect of In and Al atoms by exposure of N₂* is characterized by XRD 2θ-ω measurement.

3. Results and discussion

Fig. 4 shows a wide range ω/2θ measurement from 25 to 160 deg for In₀.₁₇Al₀.₈₃N/GaN/ AlN/DBL/Si HEMT structure. Lattice matching was not perfect because of higher angle peak separation of GaN(0006) and In₀.₁₇Al₀.₈₃N (0006). The higher angle measurement of XRD is a good tool for lattice matching interface proof.

References